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A survey of Australian prosthodontists: The use of posts in endodontically treated teeth.

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A survey of Australian prosthodontists: The use of posts in endodontically treated teeth.

Abstract and key words:

This study aimed to gain insight into common practices of Australian prosthodontists when placing a post in an endodontically treated tooth (ETT). A 17-question open- and closed-format questionnaire was sent to registered Australian prosthodontists.

The response rate was 55% (n=95). The majority of respondents indicated the purpose of a post was to retain a core (n=94, 99%). The decision to place a post is affected by the quantity of remaining tooth structure (n=91, 96%) and the definitive restoration (n=68, 72%). The ideal post length is neither a short nor long post with the most frequent response (n=52, 34%) being 'as long as possible without disturbing the apical seal'. The apical seal requirements were defined as 4-5mm of Gutta Percha for 77% of respondents. The most preferred post type was a custom cast metal post (n=85, 49%). The most popular luting cement was resin composite (n=84, 39%).

The results from this survey do not provide a definitive guide for restoring an ETT. However, it illustrates how Australian prosthodontists address this clinical challenge. The multiple responses received for a number of questions suggest that the material and technique employed in the Australian context is influenced by the individual clinical case.

Key words: Endodontically treated tooth, Posts, Questionnaire, Prosthodontics

Abbreviations and acronyms: ETT = endodontically treated tooth, GIC = glass ionomer cement, GP = gutta percha, RM-GIC = resin-modified glass ionomer cement

Introduction:

An important consideration for clinicians when restoring an endodontically treated tooth (ETT) is the need for a post. If a post is deemed necessary, then the clinician is challenged by the different options available for 'correct' or 'ideal' post placement. There are countless types of post systems available that differ not only in material and geometry, but also the clinical technique employed. A number of reviews have recommended different posts with reported benefits of improved stress distribution,[1,2] reduction in root fractures,[2] conservation of tooth structure,[3] and aesthetics.[3] Yet, clinical evidence to unequivocally support one post type over another is still lacking.[4-6]

Whilst the existing literature on posts remains perplexing,[7] the clinician is required to make choices. To better understand these choices and the clinical practices of dentists when restoring an ETT, a number of questionnaires have been conducted.[8-15] Two studies concluded that clinicians understood the principles of restoring an ETT[8,9] whilst others[10-12] identified that there was a lack of familiarity or understanding of management of the ETT by respondents. Several studies have highlighted that both continuing education and specialist training influence post selection and use[13,14] and that opinions and attitudes towards post type preferences have changed over time.[10,15]

To date, no study has been conducted to assess the attitudes and preferences of Australian prosthodontists for post use in an ETT. This study is important to gain insight into common practices and reasoning of dental specialists when deciding to place a post.

Materials and Methods:

Human Ethics approval was obtained from The University of Melbourne Human Research Ethics Committee (HREC number 1544789.1) prior to commencement of the survey.

A voluntary, anonymous questionnaire was mailed to dental practitioners who were registered as Prosthodontists throughout Australia. Prosthodontists whose addresses were publicly listed, either from the Australian and New Zealand Academy of Prosthodontists website or via a manual search of telephone directories (n = 171) were identified.

The questionnaire was accompanied with a letter explaining the study objectives and requesting anonymous participation. All questionnaires were de-identified and coded to ensure confidentiality. The return mail envelope had an identifier number that allowed a follow-up questionnaire to be mailed to non-responders one month after the first mail-out. The data collection period extended from September 2015 to March 2016.

The questionnaire comprised 17 questions, some of which had multiple parts or respondents were able to enter multiple responses to a single question. The format consisted of both open- and closed- questions. The questions were as follows:

Q1. Obtain demographic information including "University of prosthodontic specialist training", "Year of registration as a prosthodontist" and "State of work". Respondents were provided a free text space to respond.

Q2. "The primary purpose of a post is to (i) reinforce an ETT, (ii) retain a core" with the options of "yes" or "no" for each part. A free text space was provided for additional comment.

Q3. "The decision to place a post is affected by (i) quantity of remaining tooth structure, (ii) location of tooth in arch, (iii) type of planned restoration" with the option of a "yes" or "no" response for each part. A free text space was provided for "other" responses.

Q4. Complete a table for "the frequency of post placement by tooth location". Tooth location options included maxilla anterior, premolar, molar and mandibular anterior, premolar and molar and frequency options were "rarely", "sometimes" and "frequently".

Q5. Indicate the frequency for who completes the post space preparation, either the treating prosthodontist or an endodontist. Respondents were able to choose between "rarely", "sometimes" or "usually". A free text space was provided for additional comment. An additional question asked, "if prepared by an endondontist, do you provide instructions?" with the options: "rarely", "sometimes" or "usually".

Q6. "Indicate ideal post length" with the options of "post length is equal to length of crown", "post length is longer than crown", "post length is half the root length", "post length is 2/3 the root length", "post length is 4/5 the root length", "post length is as long as possible without disturbing the apical seal". More than one response could be given, and a free text space was provided for alternative suggestions.

Q7. Indicate preference for the clinical marker used to "measure post length" with the optional responses as "floor of pulp chamber", "crestal bone", "incisal/occlusal height of remaining tooth structure". A free text space was provided for alternatives answers.

Q8. Indicate the requirement for "maintenance of the apical seal" with optional responses being "requires <2mm GP", "requires 2-3mm GP", "requires 4-5mm GP", "requires >5mm GP". A free text space was provided for alternative answers.

Q9. Indicate how "post diameter is established" with responses of "conforming to existing canal diameter", "conforming to existing canal diameter with only preparation of the apical portion", "increasing canal diameter to fit prefabricated post" or "increasing diameter to strengthen post". A free text space was provided for additional comment.

Q10. Indicate how "post geometry is established" with the options of "conforming to existing canal", "conforming canal to prefabricated post type", "canal is prepared with a parallel form", "canal is prepared with a tapered form". A free text space was provided for additional comment.

Q11. Indicate "preferences for post type" and provide reasoning in a free text space against the options of "prefabricated metal, "prefabricated fibre reinforced (FRC)", "prefabricated zirconia", "custom cast metal" and "custom pressed ceramic". A free text space was also provided for alternative post type suggestions and reasons for use. An additional part asked respondents to indicate the clinical technique used for fabricating custom posts with the options of "direct pattern technique (resin/wax)", "indirect method (impression)" or "both".

Q12. Indicate "preference for post surface texture" with a "yes" or "no" response to the options of "screw/threaded (active)", "serrated/rough (passive)" or "smooth (passive)".

Q13. Indicate "yes or "no" to the timing of radiographs during the restorative process with response options of "post-endodontic treatment", "pre-post preparation", "during post preparation", "post-post preparation", and "post-restoration placement".

Q14. Indicate whether "rubber dam is routinely used" with a "yes" or "no" response.

Q15. Indicate "yes or "no" to "do you irrigate/clean the canal" at the stages of "canal preparation", "canal impression" and "cementation of post".

Q16. Indicate in tabular form the cement used and for which post type. The cement options included "GIC", "GIC-resin-modified", "resin composite" and "zinc phosphate". A free text space was provided for alternative cement suggestions.

Q17. "If you use a prefabricated post, which material/s do you use for core build-up?" with responses of "amalgam", "glass ionomer cement", "resin-modified glass ionomer", "resin composite (light-cured)", "resin composite (dual-cured)" and "pressed ceramic" provided. A free text space was available for "other" suggestions.

The data from the returned questionnaires were entered manually into a Microsoft® Excel spread sheet (Microsoft Corporation, WA, USA). Each possible response to each question was allocated its own column and any non-numerical data were numerically coded for ease of data manipulation. Frequency of responses to each question was used for descriptive statistical representation of the results.

Results:

Of the 171 questionnaires mailed out, a total of 108 questionnaires were returned. Of these, 13 were excluded as the prosthodontist had either retired, or the mailing address was incorrect. Therefore, 95 of the 171 questionnaires were used for data analysis representing an overall 55% response rate.

Demographics

From the 95 responses the numbers of graduates by institution were, 28 (29%) from the University of Melbourne, 25 (26%) from the University of Sydney, 18 (19%) from outside of Australia, 16 (17%) from the University of Adelaide, 7 (7%) from the University of Queensland and only one respondent (1%) from the University of Western Australia. The year of specialist registration was grouped into 5-year bands and is presented in Figure 1. The geographic distribution of respondents, by state in which they work, is presented in Table 1 (n=100). Three respondents indicated that they work in more than one state, whilst one respondent failed to indicate the work location.

Purpose of a post

An overwhelming majority of respondents (99%, n=94) indicated that the purpose of a post was to retain a core and 93% (n=88) of respondents indicated that a post does not reinforce an ETT.

Factors that influence the decision to place a post

Table 2 illustrates that for 96% of respondents, the quantity of tooth structure influences the decision to place a post. More than half of the respondents also believed that both the type of planned restoration (72%) and the location of the tooth in the arch (58%) influences the restorative decision. Seven respondents provided additional factors which influenced their decision to place a post.

Frequency of post placement by tooth location

Figure 2 illustrates the percentage frequency of post placement by tooth location. For maxillary and mandibular molars, and mandibular anterior teeth more than half of the respondents indicated that post placement frequency was rare. In comparison, more than half indicated that post placement occurred 'sometimes' for maxillary anterior teeth, maxillary premolar teeth and mandibular premolar teeth.

The most frequent response, independent of tooth type, was 'sometimes' representing 44% of responses. This was followed by 'rarely' at 38% and 'frequently' at 18%.

Who prepares the post space?

The majority of respondents indicated that they "usually" prepare the post space (68%). When questioned on the frequency of an endodontist preparing the post space, the most common response was "sometimes" at 43%. For the comment "I provide instructions to the endodontist", half (50%) indicated that they "usually" provide instructions and 37% responded they "rarely" provide instructions. Table 3 provides further detail on the responses.

What is the ideal post length?

A total of 154 responses was received with the most frequent response for ideal post length being "as long as possible without disturbing the apical seal" at 34%. Whilst there was a spread of responses across the options, as illustrated in Table 4, only 3% suggested that the post length should be half the root length and 2% suggested that the post length is four-fifths the root length. Ten per-cent of the responses provided alternative suggestions.

For measuring the post length, 98 responses were received. Of these, 56% (n=55) indicated post length was measured from the incisal/occlusal height of the remaining tooth structure, 24% (n=24) took measurements from the pulp chamber floor, 9% (n=9) from the crestal bone, and 10% (n=10) provided an alternative response.

Maintenance of the apical seal

When asked to indicate the requirements for maintaining an apical seal, the majority of respondents (76.8%) indicated that 4 to 5 mm of gutta percha (GP) was required. No respondent suggested that <2mm was appropriate. (Table 5)

How is post diameter established?

In total, there were 111 responses to the question, where 44% (n=49) indicated that post diameter is established by conforming to the existing canal with preparation of the apical portion only, and 35% (n=39) indicated that post diameter is established by conforming to the existing canal diameter. Canal diameter was established by increasing the diameter to fit a prefabricated post for 13% (n=14) of responses and increasing the canal diameter to strengthen a post was indicated in 8% of responses (n=9).

How is post geometry established?

Of the 117 responses obtained, 61 (52%) respondents indicated that their preparation would conform to the existing canal shape. The second highest response frequency was preparing the canal with a parallel form, with 24 (21%) responses. The option for preparing the canal with a tapered form received 20 (17%) responses. Only 12 (10%) responses indicated that post geometry is established by preparing the canal to a prefabricated post shape.

Preferences for post type and reason

There were 172 responses indicating respondents' preference for post type that are presented in Table 6. Almost half of the responses (49%) indicated a preference for a custom cast metal post. This was followed by a prefabricated metal (27%) and the FRC post at 16%. The responses were supported by 50 different reasons for post preference. For custom cast metal posts, the most popular reason was related to the intimacy of fit of the post to the canal wall. Other explanations included strength, integrity of post-core and for use when there had been extensive tooth loss. A number of respondents also indicated that they considered the custom cast post to be a conservative post option. For a prefabricated metal post, ease of use was recorded as the most frequent reason. Other explanations included use for posterior teeth and enabling direct build-up. The FRC post was preferred predominantly for aesthetic reasons and use in anterior teeth.

Technique for cast post fabrication

This question asked how practitioners fabricated their custom posts. There was a fairly even distribution between the options given with 31% (n=29) indicating that they used a direct pattern method, while a marginally greater number, 33% (n=31) indicated a preference for an indirect (impression) technique. The remainder 35% (n=33) indicated that they used both techniques. Two respondents failed to indicate the technique for custom post fabrication.

Preference for post surface texture

No respondent indicated a preference for an active screw or threaded type post. For the option of a rough, passive post, 75% indicated yes, whilst 24% indicated no. A smooth post received a 40% positive response compared to 60% negative response. It is clear there was a preference for posts to be passive in the canal with a non-smooth surface texture.

Use of radiographs

The most frequent positive responses were 'prior to commencing post preparation', either post-endodontic treatment (77%) or before post preparation (48%). For each stage of the post preparation and insertion procedure, less than 40% indicated of respondents indicated they take radiographs. (Table 7).

Use of rubber dam

Only 44% (n=42) of responses indicated that a rubber dam was routinely used during the restorative phases associated with posts.

Irrigation of the post space

The majority of respondents indicated that irrigation or cleansing the canal routinely took place throughout the restorative process with 76% (n=72) irrigating at canal preparation, 58% (n=55) at canal impression and 86% (n=82) at the time of post cementation.

Cement used for post cementation

A total of 217 responses indicated which cement respondents used for the various post types which is presented in Table 8. Resin composite cement was the most frequently used (39%). Both resin-modified glass ionomer cement (RM-GIC) and glass ionomer cement (GIC) at 25% each. Zinc phosphate was the least frequently used cement (11%).

When assessing the cement used against each post type, the most popular cement for cast posts was GIC at 34% (n=35). For cast posts, the next most popular cement was RM-GIC

(27%), followed by resin composite (25%) and zinc phosphate (13%). In comparison, resin composite was the most commonly used cement for prefabricated posts at 40% (n=21), and FRC posts at 85% (n=25).

Core build-up material

Associated with prefabricated post placement is the use of a core material. In total, 158 responses were received. (Table 9) The most popular core material was dual-cured resin composite (34%). Both light-cured resin composite and amalgam were used at similar rates, 29% and 28% respectively. Resin-modified GIC and GIC were the least used core material at only 2% each.

Discussion:

This study aimed to gain insight into the preferences of specialist Prosthodontists in Australia when placing a post in an ETT. The number of returned questionnaires was 55% of the mail-out, which is slightly lower than comparable questionnaires in other countries.[8-15] The questionnaire did capture a diverse spread of respondents by date of first registration, and therefore years of practice as a specialist. The geographic distribution of respondents was consistent with data presented by the Dental Board of Australia which lists the principal place of practice of Prosthodontists throughout Australia (www.dentalboard.gov.au). Unfortunately, the response rate was insufficient to make valid comparisons based on the demographic information.

What influences post placement?

The responses for this questionnaire were consistent with the research on ETT which has demonstrated that posts do not act to reinforce the tooth and should only be utilised for the purpose of retaining a core.[16] Subsequently, the challenge for the clinician is to decide when a core requires retentive assistance from a post. As a general rule, it has been suggested that for posterior teeth, the size and shape of the pulp chamber can provide adequate retention for a core, though for anterior teeth and premolars the smaller pulp chamber may be inadequate for core retention.[17] Researchers have attempted to refine this broad categorisation by correlating the amount of remaining tooth structure with the need for a post.[18-20] Yet other factors, such as the definitive restoration and the preparation requirements, will influence the quantity of remaining tooth structure.[21,22] The majority of the prosthodontists in this survey

acknowledged that both the quantity of tooth structure and the type of planned restoration influenced their decision to place a post.

While the location of the tooth in the arch seemed to be less of an influence for respondents in determining the need for a post, the results suggest that it was rare for this group to place posts in molar teeth or in the mandibular anterior teeth.

Post dimensions and preparation

When preparing a canal for post placement, the clinician must consider the competing requirements of structural integrity of the post, features that improve retention and the anatomical limitations of the tooth. Research has cautioned against increasing post diameter excessively during canal preparation as it risks compromising the structural integrity of the root.[23] Whilst many respondents indicated they would conform to the existing canal, 44% did reply that they would prepare the apical portion of the canal. Given the irregular cross-sectional shape of many roots, particularly in the apical portion,[24] the benefit versus risk has to be questioned. For both post diameter and geometry, it was not common practice to modify the canal shape for a prefabricated post. This brings into discussion whether intimacy of fit or the cement are the primary determinants of post retention when prefabricated posts are placed.

Whilst there was no consensus on what respondents believe is the ideal length for a post, it was clear that neither a short (1/2 the root length) nor a long post (4/5 root length) were perceived as ideal. The majority of respondents did indicate that an apical seal of 4-5mm of gutta percha was necessary. This highlights the clinical challenge of trying to achieve a post, sufficiently long to facilitate retention, yet respect the minimum requirement of gutta percha to maintain an apical seal.[18]

During the phases of post preparation, the majority of respondents irrigated the canal. In contrast, a majority indicated that rubber dam was not routinely used during post preparation and placement. Whilst irrigation is important for disinfecting the root canal,[25] recommendations for the use of rubber dam during prosthetic treatment of an ETT have been made as it has also been shown to improve endodontic outcomes.[26]

Post and core material

With the advent of many newer materials and different post systems, the use of cast posts may be considered old fashioned when restoring an ETT, but it remains popular with the

specialist community responding to the survey. This is consistent with the results from Eckerbom and Magnusson in their survey of Swedish Prosthodontists, but contrasts with the results from Sarkis-Onofre et al. who compared differences in opinion between dentists with and without postgraduate training in southern Brazil.[13,14]

When using a prefabricated post, dual-cured resin composite, light-cured composite and amalgam were the most commonly used core materials. The use of GIC and RM-GIC were rarely employed as a core material, presumably because of the inherent brittleness and relatively low fracture strength of GICs.

CementsA range of cements for different posts can be used when restoring an ETT. Resin cement was the most popular cement used for all post types. Unfortunately, the survey did not explore the reasoning for the choice of cement. Whilst it is known that resin cements are resistant to fracture, the adhesive strength to dentine still remains low. Interestingly, zinc phosphate is still being used by a number of the respondents even though it is the most soluble amongst all the luting cements used. To date, there are no clear guidelines for cement choice for post placement.[27] It was surmised that luting cement selection is based on practitioner preference, clinical experience and possibly perceived retentiveness of the post and core.

Without clear recommendations, clinicians are often left questioning, 'what is the best treatment?' when faced with utilising a post in an ETT. Whilst the results from this survey do not provide a definitive guide on restoring an ETT, they do illustrate how Prosthodontists in Australia address this clinical challenge. The variety of responses received suggest that the material and technique employed for post selection, preparation and placement by Prosthodontists in the Australian context is influenced by the individual clinical case.

Unfortunately, one of the limitations of this study was the low response rate. Given a higher response rate, there would have been the opportunity to compare treatment preferences amongst respondents based on their demographic factors, years of specialty practice and/or the university of specialty training. This would have been particularly useful to identify any trends in the responses. For example, is the preferred post material selection and preparation method a reflection on when or where a prosthodontist was trained? A second limitation of the study is the quality of the information received via a questionnaire. This may not accurately reflect the actual clinical behaviour of the respondents. Ideally, the establishment

of a study where real time decisions regarding management of an ETT are recorded would enhance our appreciation of the decision making process. This would also eliminate the reflective component as reported in the current survey.

Conclusion:

Within the limitations of the study, the following conclusions were drawn regarding the use of posts by Australian Prosthodontists:

- The majority of prosthodontists believe the purpose of a post is to retain a core and not to reinforce an ETT;
- The decision to place a post is affected by the quantity of remaining tooth structure, and the type of planned restoration;
- The majority of prosthodontists indicated that 4-5mm of gutta percha is required for maintenance of the apical seal;
- A preference for cast posts exists followed by prefabricated metal then FRC posts. There is no clear preference for either the indirect or direct technique for fabrication of a cast post.
- Resin composite cement was the most popular cement for use with posts.

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Tables

Table 1 State in which respondents work[†]

State	Respondents
ACT	2 (2)
NSW	27 (27)
NT	1 (1)

QLD	16 (16)
SA	9 (9)
TAS	1 (1)
VIC	32 (32)
WA	11 (11)
No response	1 (1)
Number of responses	100 (100)

ǂ Figures represent number of respondents with the percentage given in parentheses

Table 2 *Responses to "w*hat influences the decision to place a post?"ǂ

Questions	Number of responses	Yes	No
Quantity of remaining tooth structure	95	91 (96)	4 (4)
Location of tooth in arch	95	55 (58)	40 (42)
Type of planned restoration	95	68 (72)	27 (28)

ǂ Figures represent number of respondents with the percentage given in parentheses

Table 3 Responses to *"w*ho prepares the post space?"ǂ

Questions	Number of responses	Usually	Sometimes	Rarely
I prepare the post space	95	65 (68)	23 (24)	7 (7)
An endodontist prepares the post space	92	20 (22)	40 (43)	32 (35)
I provide instructions to the endodontist	86	43 (50)	11 (13)	32 (37)

ǂ Figures represent number of respondents with the percentage given in parentheses

Table 4 *Responses to "w*hat is the ideal post length?*"*ǂ

Options	Responses
As long as possible without disturbing the apical seal	52 (34)
Post length is longer than the crown	33 (21)
Post length is equal to length of crown	26 (17)
Post length is 2/3 the root length	20 (13)
Other	15 (10)
Post length is ½ root length	5 (3)
Post length is 4/5 root length	3 (2)
Number of responses	154 (100)

ǂ Figures represent number of respondents with the percentage given in parentheses

Table 5 *Responses to "w*hat are the apical seal requirements?ǂ

Options	Responsesǂ
4-5mm GP	73 (76.8)
>5mm GP	11 (11.6)
2-3mm GP	10 (10.5)
Other	1 (1.0)
<2mm GP	0 (0.0)
Number of responses	95 (100)

ǂ Figures represent number of respondents with the percentage given in parentheses

Table 6 What is your preference for post type?ǂ

Options	Responsesǂ
Custom cast metal	85 (49)
Prefabricated metal	46 (27)
Prefabricated fibre reinforced	28 (16)
Custom pressed ceramic	9 (5)
Prefabricated zirconia	3 (2)
Other	1 (0)

Number of responses	172 (100)

ǂ Figures represent number of respondents with the percentage given in parentheses

Table 7 When are radiographs taken? ǂ

Questions	Number of responses	Yes	No
After endodontic treatment	94	72 (77)	22 (23)
Before post preparation	94	45 (48)	49 (52)
During post preparation	95	38 (40)	57 (60)
After post preparation	95	36 (38)	59 (62)
After post insertion	94	32 (34)	62 (66)
After restoration placement	93	36 (39)	57 (61)

ǂ Figures represent number of respondents with the percentage given in parentheses

Table 8 – Responses indicating use of cement with various post types. ǂ

Cement	Cast post	FRC	Prefabricated metal	Other	Total
GIC	35	-	15	4	54 (25)
RM-GIC	28	4	13	10	55 (25)
Resin Composite	26	25	21	12	84 (39)
Zinc Phosphate	13	1	3	7	24 (11)
Total	102	30	52	33	217 (100)

ǂ Figures represent number of respondents with the percentage given in parentheses

Table 9 Core build up material used with a prefabricated post.[†]

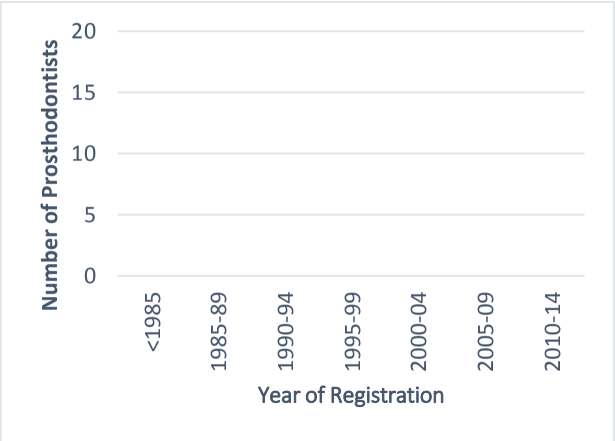
Options	Responses
Resin composite (dual-cured)	54 (34)
Resin composite (light-cured)	46 (29)
Amalgam	45 (28)
Pressed ceramic	7 (4)
Resin modified GIC	3 (2)
GIC	3 (2)
Total number of responses	158 (100)

[†] Figures represent number of respondents with the percentage given in parentheses

Figures

Fig 1. Distribution of respondents by year of specialist registration.

Fig 2. Percentage frequency of post placement based on tooth location.



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